

**RETRACTABLE ROTATABLE CAMERA MODULE FOR MOBILE
COMMUNICATION DEVICE AND METHOD OF OPERATION THEREOF**

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TECHNICAL FIELD OF THE INVENTION

[0001] The present invention is directed, in general, to wireless telecommunications and, more specifically, to a retractable rotatable camera module for a mobile communication device and method of operating the same.

BACKGROUND OF THE INVENTION

[0002] Mobile communication devices, such as mobile telephones, are increasingly used for more than just speech communication. A variety of applications like messaging services, data communication, e-mail or fax services have become available to the users of mobile communication devices.

[0003] The ongoing development in digital imaging devices makes it possible today to equip mobile communication devices with digital cameras at affordable prices, which gives rise to a host of new multimedia services. Such digital cameras allow one party to take digital photographs and send them to another by means of the well known multimedia message system (MMS) standard. Even video telephony can be established between two mobile communication

devices, provided they are each equipped with a camera. The display is integral part of such applications, for viewing functions in the case of digital photography or so each party can see the other in the case of video telephony.

[0004] A problem, which consequently arises is that a different arrangement of display in relation to camera is required to support services such as digital photography and video telephony in the same device. More specifically, they have to face in opposite directions in digital photography, whereas the display and camera have to face in the same direction in video telephony.

[0005] This problem can be solved by equipping the mobile communication device with two cameras, one facing in the same and another facing in the opposite direction of the display. The use of two cameras in a single mobile communication device is taught in, for instance, United States patent application publication US 2003/0036365 to Kuroda, entitled "Portable Communications Terminal with Camera Capable of Taking Pictures." However, using two cameras leads to a significantly more expensive and complex mobile communication device.

[0006] Accordingly, what is needed in the art is a less expensive way to bring both digital photography and video telephony functionality to a mobile communication device.

SUMMARY OF THE INVENTION

[0007] The present invention addresses the above-described shortcomings of the prior art by introducing a mobile communication device with imaging means, which can be flexibly used for different applications or services, such as digital photography or video telephony.

[0008] To address the above-discussed deficiencies of the prior art, in one aspect, the present invention provides a mobile communication device having a camera module and a method of operating a mobile communication device having a camera module. In one embodiment, the mobile communication device includes: (1) a main body and (2) a camera module, coupled to the main body and configured for movement with respect thereto between a retracted position and an exposed position and rotatable in the exposed position about at least one axis of rotation.

[0009] In another aspect, the present invention provides a mobile communication device. In one embodiment, the mobile communication device includes: (1) a main body having attaching means for attaching a camera module and (2) a camera module having complementary attaching means to the main body, such that the camera module is movable with respect to the main body from a retracted position to an exposed position and is rotatable in the exposed position about at least one axis of rotation.

[0010] In yet another aspect, the present invention provides a camera module. In one embodiment, the camera module includes: (1) attaching means for attaching the camera module to complementary attaching means of a mobile communication device and (2) a camera, coupled to the attaching means, the camera movable with respect to a main body of the mobile communication device from a retracted position to an exposed position and rotatable in the exposed position about at least one axis of rotation.

[0011] In still another aspect, the present invention provides a method of operating a retractable rotatable camera module. In one embodiment, the method includes: (1) deploying the camera module by releasing a user-releasable retainer, the camera module to move from a retracted position to an exposed position with respect to a main body of an associated mobile communication device and (2) rotating the camera module about at least one axis of rotation.

[0012] The foregoing has outlined, rather broadly, preferred and alternative features of the present invention so that those skilled in the art may better understand the detailed description of the invention that follows. Additional features of the invention will be described hereinafter that form the subject of the claims of the invention. Those skilled in the art should appreciate that they can readily use the disclosed conception and specific embodiment as a basis for designing or modifying other structures for carrying

out the same purposes of the present invention. Those skilled in the art should also realize that such equivalent constructions do not depart from the spirit and scope of the invention in its broadest form.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] For a more complete understanding of the present invention, reference is now made to the following descriptions taken in conjunction with the accompanying drawings, in which:

[0014] FIGURE 1 illustrates a schematic front view of one embodiment of a mobile communication device with a retractable camera module rotatable about one axis of rotation and constructed according to the principles of the present invention;

[0015] FIGURES 2A and 2B illustrate schematic right-hand side views of the mobile communication device of FIGURE 1 with the camera module in a front side (FIGURE 2A) and a back side (FIGURE 2B) position;

[0016] FIGURE 3 illustrates an enlarged schematic side view of a second embodiment of a camera module rotatable about two axes of rotation and constructed according to the principles of the present invention; and

[0017] FIGURE 4 illustrates a flow diagram of one embodiment of a method of operating a retractable rotatable camera module for a mobile communication device carried out according to the principles of the present invention

DETAILED DESCRIPTION

[0018] Referring initially to FIGURE 1, illustrated is a mobile telephone 100, which is equipped with a retractable and rotatable camera module 200. When in use the camera module 200 is in the exposed position shown in FIGURE 1. When the camera associated with the camera module 200 is not in use, the camera module 200 is retractable into a main body 110 of the mobile telephone 100. This retracted position is indicated by reference number 210.

[0019] In this embodiment the camera module 200 comprises a flash 124 and a self-timer (not shown), which is connected to a light-emitting diode (LED) 126 for indicating the elapsing of the delay time of the self-timer.

[0020] The camera module 200 is shown with a lens 122 thereof facing to the front side of the mobile telephone 100, the front side being defined as the side of the mobile telephone 100 on which a display 112 and a keypad 114 are arranged. This is the typical position suitable for an application such as video conferencing. By rotating the camera module 200 by about 180°, the camera module 200 now faces to the back side of the mobile telephone 100, which is a suitable position for taking digital photographs.

[0021] The camera module 200 is shown in FIGURE 1 as being mounted at the top side of the mobile telephone 100. Of course, the camera module 200 could be mounted at the side of the mobile

telephone 100 or at any position, in which it can be rotated to face to the front or the back side of the mobile telephone 100 as described above.

[0022] Certainly, the invention is not limited to mobile telephones, but can also be used for personal digital assistants (PDAs) or mobile digital assistants (MDAs) or any other conventional or later-developed mobile communication device.

[0023] Turning now to FIGURES 2A and 2B, the mobile telephone 100 of FIGURE 1 is shown from the left-hand side to demonstrate further the rotating movement of the camera module 200. In FIGURE 2A, the camera module 200 is in the front side position. In FIGURE 2B, the camera module 200 is rotated by about 180°, which causes the camera module 200 to face the back side of the mobile telephone 100.

[0024] Turning now to FIGURE 3, illustrated is another embodiment of the camera module 200. In this embodiment, the camera module 200 is rotatable about two axes of rotation, which are essentially perpendicular to one another. That way the camera module 200 can not only be rotated about a vertical axis as shown in FIGURES 1, 2A and 2B, but can also be tilted and thus rotated about a horizontal axis of rotation. Positions, in which the camera module is tilted forward and backward are indicated by reference numbers 220 and 230 respectively.

[0025] FIGURE 3 also shows, in highly schematic form, an optional spring 310, by which the camera module 200 can be automatically ejected and brought into the exposed position. For this purpose, an optional user-releasable retainer 320 may be provided to retain the spring in a compressed position until the user releases it. In the alternative, the camera module 200 could be automatically ejected by means of an electromagnet or motor or manually pulled out by the user. Finally, if the camera module 200 is wholly detachable from the mobile telephone 100 of FIGURE 1, an attaching means 330 is associated with the camera module 200. The attaching means 330 releasably engages a corresponding attaching means located on or in the mobile telephone 100.

[0026] Turning now to FIGURE 4, illustrated is a flow diagram of one embodiment of a method of operating a retractable rotatable camera module for a mobile communication device carried out according to the principles of the present invention. The method begins in a start step 410 when a user wishes to deploy a camera either to take a digital photograph or engage in video telephony.

[0027] The method proceeds to a step 420 in which a user deploys a camera module containing the camera by releasing a user-releasable retainer. In response, a spring extends, causing a camera module to move from a retracted position to an exposed position with respect to the main body of the mobile communication device.

[0028] Next, in a step 430, the user rotates the camera module about at least one axis of rotation. Then, in an optional step 440, a detector, in particular an electronic detector, may detect the position of the camera module relative to the main body of the mobile communication device, including perhaps the rotational orientation of the camera module. The power supply of the camera module may then be automatically switched on. Also, the display of the mobile communication device may be configured for a particular application, such as digital photography or video telephony.

[0029] Next, in an optional step 450, a flash may be activated if the user intends to take a digital photograph. A self-timer may be used to measure a delay time before automatically taking a photograph. The elapsing of the delay time can be indicated by appropriate indicator, such as an LED, which may flash with an ascending frequency during the delay time. The method ends in an end step 460, when the user ostensibly urges the camera module back into a retracted position within the main body.

[0030] Although the present invention has been described in detail, those skilled in the art should understand that they can make various changes, substitutions and alterations herein without departing from the spirit and scope of the invention in its broadest form.